STATUS REVIEW OF *Aquilegia brevistyla*

U.S.D.A. FOREST SERVICE - REGION 1

LEWIS & CLARK NATIONAL FOREST

MONTANA

Prepared by:

Lisa Schassberger Roe, Botanist
Montana Natural Heritage Program
State Library Building
1515 E. 6th Avenue
Helena, MT 59620

Challenge Cost-share Project

January 1992

This document should be cited as follows:

Roe, L.S. 1992. Status review of Aquilegia brevistyla, Lewis & Clark National Forest. Montana Natural Heritage Program. Helena, MT. 47 pp.

TABLE OF CONTENTS

Note: In the following report, numbers in parentheses after site names refer to the Montana Natural Heritage Program occurrence numbers for those sites.

I. SUMMARY

This report summarizes the findings of field surveys conducted from 1-5 July 1991, by the Montana Natural Heritage Program, and fieldwork completed by Lewis & Clark National Forest personnel, for Aquilegia brevistyla (short-styled columbine) on the Lewis & Clark National Forest in Montana.

This member of the Ranunculaceae (Buttercup Family) is peripheral in Montana, and is found more commonly to the north in Canada and Alaska. Prior to the 1991 field season, this species was known from only two verified locations within Montana; both were in the Little Belt Mountains, on Lewis & Clark National Forest lands. A third population on the Boulder River south of Big Timber, MT, was unverified due to a questionable specimen. Field surveys conducted during 1991 by Montana Natural Heritage Program and Lewis & Clark National Forest personnel revealed seven new populations, all in the Judith River watershed. The Boulder River population remains unverified. Of the nine known populations of A. brevistyla, two contain plants that exhibit characteristics intermediate to A. brevistyla and A. flavescens. Hybridization is extremely common among species in the genus Aquilegia and may be occurring here. A chromosome count and an electrophoretic study of the Montana populations might confirm the presence of the suspected hybrids.

Fire swept through the Sage Creek (003) population in the fall of 1990. Field observations in 1991 indicate that in lightly burned areas, where the duff remained intact, plants survived. Plants did not survive in areas where the duff was eliminated by hot fire. Observations of the Sage Creek (003) population should continue for several years to determine long term fire effects, especially with respect to the removal of shade and logging activities.

Further survey work will be necessary to try to verify the Boulder River (002) record. Additional surveys should also be completed in the Judith River watershed to better detail the range of this species.

II. SPECIES INFORMATION

A. CLASSIFICATION

1. **SCIENTIFIC NAME:** Aquilegia brevistyla Hook.

2. **SYNONYMS:** A. vulgaris var. brevistyla Gray, in Amer. Journ. Sci. ser. 2, xxxiii, 243 (1862); A. brevistyla var. vera Bruhl, in Journ. Asiatic Soc. Bengal, lxi, pt. 2, 319, (1893); A. brevistyla var. altior Rapaics, in Bot. Kozlem. viii, 132 (1909).

3. **COMMON NAME:** short-styled columbine.

4. **FAMILY:** Ranunculaceae (Buttercup Family).

5. **GENUS:** According to Hitchcock et al. (1964), there are about 70 species of columbine in the Northern Hemisphere, chiefly found in the mountains. Munz (1946) recognized 67 species. Dorn (1984) recognizes five species for Montana. The genus shows high interfertility, with polyploidy quite rare, and diploid interspecific hybrids that show little sterility. Interfertility is as common between species on opposite sides of the earth as between geographically related species (Munz 1946). Munz (1946) felt that in nature, species of Aquilegia are likely to exist only where some degree of isolation occurs, geographical or altitudinal, and only where there are overlapping ranges is intergradation to be expected. Indeed, Clausen et al. (1945) state: "These results lead to the conclusion that Aquilegia is one huge cenospecies composed of only a few ecospecies. Probably most of the recognized 'species' are merely morphologically distinguishable ecotypes or subspecies. This evolutionary status is of much interest, because it possibly represents a youthful stage experienced by many other, now mature genera, before they developed a strong barrier to interbreeding, with polyploidy following."

6. **SPECIES:** Aquilegia brevistyla is characterized by blue and white pendulous flowers, hooked spurs which are shorter than the laminae, included stamens, and short styles. This combination of characters positions it closer to Asiatic species than other American species except A. saximontana and A. laramiensis, both of which have shorter

stems with flowers in among the leaves (Munz 1946).

B. PRESENT LEGAL OR OTHER FORMAL STATUS

1. FEDERAL STATUS

a. U.S. FISH AND WILDLIFE SERVICE: None.

b. U.S. FOREST SERVICE: Aquilegia brevistyla is currently included on the list of sensitive plant species for Region 1 (Northern Region) of the U.S. Forest Service. Agency objectives and policy in the 1984 Forest Service Manual provide for the management and protection of sensitive species (Section 2670.32). Under these guidelines, the U.S. Forest Service is to "(a)void or minimize impacts to species whose viability has been identified as a concern" (2670.32.2).

2. STATE: Prior to the 1991 field season, Aquilegia brevistyla was listed by the Montana Natural Heritage Program (Achuff 1991) as "critically imperiled in the state" (state rank = S1). With the addition of seven new locations from 1991 field surveys by U.S. Forest Service and Montana Natural Heritage Program personnel, the state rank will be changed to S2, "imperiled because of rarity."

It is recommended as "sensitive" (any species, that is known from a limited number of populations in Montana) by Lesica and Shelly (1991).

3. OTHER STATUS: Aquilegia brevistyla is listed as "rare and threatened in Wyoming" by the Wyoming Natural Diversity Data Base (Marriott 1991). Although restricted to the Black Hills region of South Dakota, this species is locally common there (Dave Ode 1991).

C. DESCRIPTION

1. GENERAL NONTECHNICAL DESCRIPTION: The short-styled columbine grows from 8-32 inches in height. The branched stems are fuzzy-hairy, and bear short-stemmed, compound leaves, each composed of three maple leaf-shaped leaflets. Flowers droop on short stems at the upper nodes, each composed of five petals and five sepals. The petal blades are white and rounded at the tip, while the

backward extension, the spur, is short, hooked, and blue in color. Five pointed, blue sepals, flare out behind the petals. The styles are short, usually near 1/8 inch long. When ripe, the dry tubular elongate fruits contain numerous black, shining, narrow arcuate seeds (adapted from Munz 1946).

2. **TECHNICAL DESCRIPTION:** Stems 2-8 dm high, 1.5-3.5 mm thick, glabrous to pilose below, pilose and more or less glandular above, simple to branched above; basal leaves few, biternate, rather thin, green and glabrous above, glaucous and glabrous to pilose beneath; petioles 3-18 cm long, slender, subglabrous to pilose; primary petiolules 1-5 cm long, usually pilose, secondary up to 1 cm long; leaflets round-obovate to wider, 1-4 cm long, cleft to about the middle, each division with few round-oblong often slightly emarginate lobes; cauline leaves gradually reduced up the stem, the leaflets narrower, about 1 dm long; flowers nodding, pilose; sepals blue, slightly spreading, lanceolate, acuminate to acute, 13-16 mm long; laminae yellowish-white, oblong, rounded-truncate, 8-10 mm long; spurs blue, hooked, 6-7 mm long, about 3 mm wide at base; stamens scarcely equalling laminae, anthers yellow, about 1 mm long; staminodia 6-7 mm long, plane, abruptly acute; follicles 5-6, glandular and pilose, 15-25 mm long, often divergent above, the styles 3-4 mm long; seeds about 1.5 mm long (Munz 1946).

3. **LOCAL FIELD CHARACTERS:** In Montana, A. brevistyla is differentiated from other blue-flowered columbines by a combination of characteristics including: the length of the style, length of the spurs, the size of the plant, and the presence and size of leaves along the stem. Aquilegia brevistyla differs from A. coerulea by having short spurs (versus long spurs), and from A. jonesii by having leaves along the stem, and leaf blades mostly over 15 mm long (versus only basal leaves with blades that are less than 15 mm long).

Munz (1946) reported hybridization between A. brevistyla and A. flavescens, citing the specimens Macoun (95889, 95890) from Goat Mountain, Jasper Park, Alberta, with "sepals spreading, blue, 16-20 mm. long; laminae whitish or pale, 6-8 mm. long; spurs not hooked, 5-14 mm. long." Information presented under Reproduction and Taxonomy, Section F.3.a., p. 11, indicates that A.

brevistyla may be hybridizing with A. flavescens in Montana. It is imperative that specimen collections be made for determination, noting color while still fresh, and making morphologic measurements of style length and spur length.

Apparent hybrids between A. jonesii and A. flavescens (Aquilegia x elatior (Strickler 1991)) have been observed in Glacier National Park that are superficially similar to A. brevistyla (DeSanto 1991, Lesica and Shelly 1991).

D. GEOGRAPHICAL DISTRIBUTION

1. **RANGE:** Aquilegia brevistyla ranges from Alaska and the Yukon, south to British Columbia where it is common; and to Alberta, Manitoba, Ontario, Minnesota, South Dakota, Montana, and Wyoming, where it is known peripherally (Hitchcock et al. 1964, Scoggan 1978). It is found locally in the Black Hills of South Dakota (Ode 1991). This species is currently known from the mountainous region of the Little Belt Mountains of central Montana, with an unverified location in the Absaroka Range along the Boulder River in south-central Montana.

2. **CURRENT SITES:** There are currently seven populations that contain A. brevistyla in Montana, and two populations that contain A. brevistyla and what appear to be intermediates between A. flavescens and A. brevistyla, as determined from morphologic evidence. All of these sites occur in the Judith River watershed in the northeast corner of the Little Belt Mountains.

   The locations of these nine currently known, and the one unverified site for A. brevistyla in Montana are shown on a map, Figure 1, p. 6. The legal descriptions, latitudes and longitudes, elevations, USGS topographic map names, and locations of the occurrences in Montana are found in the Element Occurrence records, pp. 25-35. Exact locations for nine of the sites are shown on U.S.G.S. topographic maps pp. 36-41.

3. **HISTORICAL SITES:** None known.

4. **UNVERIFIED/UNDOCUMENTED REPORTS:** A specimen collected in July of 1967, from 20 miles above the town of McLeod (Sweetwater County) along the Boulder River is unverified. The identity of the

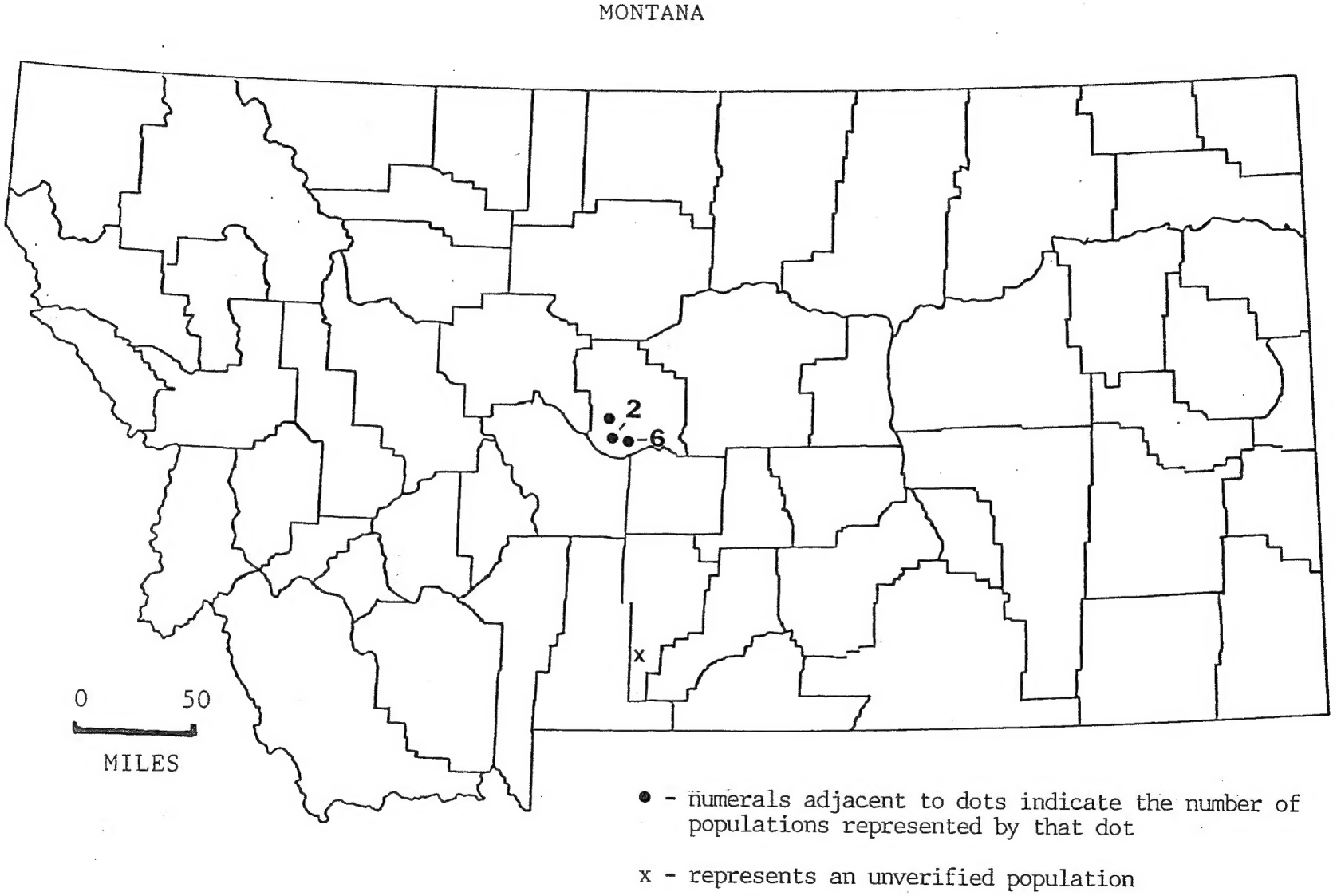


Figure 1. Distribution of Aquilegia brevistyla populations in Montana.

specimen remains uncertain (Lesica and Shelly 1991), and brief surveys for this population in 1989 by Sarah Mathews for the Montana Natural Heritage Program were unsuccessful. Aquilegia flavescens was observed in flower by this author at Aspen Campground, on the Boulder River, on 5 June 1991. Further survey work will be necessary to locate and try to verify this record.

As stated above, this site is included on the state map (p. 6) and information on the site can be found in the Element Occurrence records, Section V, p. 25. However, since an exact location of this occurrence is not known, a U.S.G.S. topographic is not included. Also, this site will not be referenced in much of the discussion that follows.

5. **AREAS SURVEYED BUT SPECIES NOT LOCATED:** The following areas were surveyed by the author for A. brevistyla because the habitat appeared to be suitable on the topographic maps, but the species was not located within them. The actual areas surveyed may be smaller than the portions of the sections indicated.

T09N R08E SEC 16, NW¼SW¼
T09N R08E SEC 17, NE¼NW¼
* T10N R12E SEC 01, SE¼, NW¼
* T11N R12E SEC 35, SE¼
* T11N R18E SEC 05, SE¼SE¼
* T11N R18E SEC 08, NE¼NE¼
T14N R10E SEC 12, NE¼NE¼
T14N R11E SEC 06, SW¼SW¼
T15N R10E SEC 29, NW¼SE¼
T15N R10E SEC 31, SE¼SW¼

Areas marked by a star contained A. flavescens.

In addition, Wayne Phillips (Ecologist, Lewis & Clark National Forest) surveyed for A. brevistyla in drainages of Little Snowy Mountains and in the Crystal Lake area of the Big Snowy Mountains in 1991 without result.

E. HABITAT

1. **GENERAL DESCRIPTION AND ASSOCIATED VEGETATION:** Aquilegia brevistyla occurs in open woods and on stream terraces at mid-elevation in the mountains. Populations in Montana occur at elevations from 5000-6000 feet (1525-1830 m) (Lesica and Shelly

1991), in the ecotone between Picea engelmannii/Pseudotsuga menziesii (Engelmann spruce/Douglas fir) forest and Festuca scabrella/Poa pratensis (rough fescue/common timothy) meadows. Moss cover was often high. Species present included, Hylocomium splendens, Pleurozium schreberi, Drepanocladus uncinatus, Timmia austriaca, and Thuidium abietinum.

Other associated species include:

Abies lasiocarpa (subalpine fir)
Picea engelmannii (Engelmann spruce)
Pinus contorta (lodgepole pine)
Pinus ponderosa (ponderosa pine
Pseudotsuga menziesii (Douglas fir)

Acer glabrum (Rocky Mountain maple)
Antennaria racemosa (raceme pussytoes)
Arctostaphylos uva-ursi (kinnikinnick)
Arnica cordifolia (heart-leaf arnica)
Aster conspicuus (showy aster)
Athyrium filix-femina (lady-fern)
Calamagrostis rubescens (pinegrass)
Calypso bulbosa (fairy-slipper)
Clematis columbiana (Columbia clematis)
Cypripedium montanum (mountain lady's-slipper)
Festuca idahoensis (Idaho fescue)
Festuca scabrella (rough fescue)
Fragaria virginiana (Virginia strawberry)
Galium boreale (northern bedstraw)
Galium triflorum (sweetscented bedstraw)
Geranium richardsonii (white geranium)
Goodyera repens (northern rattlesnake-plantain)
Habenaria viridis (frog orchis)
Juniperus communis (common juniper)
Linnaea borealis (twinflower)
Phleum pratense (common timothy)
Poa pratensis (Kentucky bluegrass)
Potentilla fruticosa (shrubby cinquefoil)
Pyrola secunda (one-sided wintergreen)
Ribes lacustre (swamp currant)
Schizachne purpurascens (false melic)
Shepherdia canadensis (Canada buffaloberry)
Smilacina stellata (starry Solomon-plume)
Spiraea betulifolia (shiny-leaf spiraea)
Thalictrum occidentale (western meadowrue)
Viola canadensis (Canada violet)

2. **TOPOGRAPHY:** In Montana, A. brevistyla is known to occur in the Little Belt Mountains, in the Judith

River watershed. Populations occur at mid-elevations (5000-6000 ft. (1525-1830 m)), on slopes that range from 0-40 percent. Most of the populations occur on toeslopes and along valley bottoms.

3. **SOIL RELATIONSHIPS:** In Montana, A. brevistyla has been found on alluvial and colluvial limestone substrates. Populations occur on soils derived from Madison Limestone, the Monarch Formation (brown & black granular limestone capped by shale), and the Barker Formation (limestone and micaceous shale, containing beds of limestone conglomerate and quartzite at the base) (Weed 1899).

4. **REGIONAL CLIMATE:** The regional climate of central Montana is characterized by warm summers and cold, snowy winters. The precipitation peak in central Montana is generally as rain or wet snow in May and June (U.S. Department of Commerce 1982).

The climatic station closest to the central Montana sites is at Stanford (elevation 4308 ft. (1315 m)), which is approximately 18 miles northeast, and about 1500 feet (460 m) lower than most of the sites in the Little Belt Mountains. For the period 1951-1980 (U.S. Department of Commerce 1982), the January mean temperature was 20.5°F (2.6°C), the July mean temperature was 65.2°F (18.6°C), and the annual mean temperature was 43.2°F (6.3°C). The mean annual precipitation was 15.34 inches (38.4 cm), with May (3.01 inches) (7.5 cm) and June (3.07 inches) (7.7 cm) being the wettest months.

F. POPULATION DEMOGRAPHY AND BIOLOGY

1. **PHENOLOGY:** Plants begin flowering in Montana in late May and early June, and often continue to flower through early July. June of 1991 was a very wet and cold month across most of the state, including the Little Belt Mountains. Several populations of A. brevistyla were at the height of bloom on July 1, nearly two weeks later than the previous year. Fruit and seed set usually occur in July and August.

2. **POPULATION SIZE AND CONDITION:** The following population sizes are underestimated, since flowering plants are usually the most visible and are easily counted. It was not practical to try

to count plants in the vegetative state for entire populations, since the leaf morphology and architecture of Thalictrum occidentale and A. brevistyla are nearly indistinguishable in a forest setting.

Dry Pole (001)
Population size: ca. 45 plants in 2 main subpopulations.
Population condition: several plants show characteristics intermediate to A. brevistyla and A. flavescens.
Acreage covered by population: 1
Last observation date: 1991

Boulder River (002)
Population size: 0
Population condition: unknown.
Acreage covered by population: unknown.
Last observation date: 1967

Sage Creek (003)
Population size: ca. 2000 plants (1990), ca. 770 - 1000 in 1991.
Population condition: site burned in fall of 1990, population size was difficult to estimate in 1991 as a number of plants were only in a vegetative state.
Acreage covered by population: 15
Last observation date: 1991

Burris Trail (004)
Population size: ca. 100 plants.
Population condition: good.
Acreage covered by population: 1
Last observation date: 1991.

Burley Creek (005)
Population size: ca. 2000 plants.
Population condition: good.
Acreage covered by population: ca. 300.
Last observation date: 1991

High Spring Creek (006)
Population size: 100-200 plants.
Population condition: good.
Acreage covered by population: ca. 30.
Last observation date: 1991

Hay Canyon (007)
Population size: ca. 800-1000 plants.
Population condition: good condition, many plants in disturbed roadside berms.
Acreage covered by population: ca. 40.
Last observation date: 1991

South Fork Judith River (008)
Population size: ca. 10-15 plants.
Population condition: good, could be easily disturbed by roadside activities.
Acreage covered by population: 1
Last observation date: 1991

South Fork Judith River (009)
Population size: ca. 25 plants.
Population condition: several plants show characteristics intermediate to A. brevistyla and A. flavescens.
Acreage covered by population: 1
Last observation date: 1991

Smith Creek (010)
Population size: ca. 2 plants, more survey needs to be completed in this drainage.
Population condition: unknown.
Acreage covered by population: 1
Last observation date: 1991

3. REPRODUCTION AND TAXONOMY

Most members of the genus Aquilegia are outcrossers and are known to easily hybridize. For 56 out of 58 taxa in the genus Aquilegia, 2n=14 (Dawe and Murray 1981). Dawe and Murray (1981) report 2n=16 for A. brevistyla. If A. brevistyla is an aneuploid, it is less likely that it would produce fertile hybrids. However, collections made in the Little Belt Mountains by this author during the 1991 field season are problematic, and Munz (1946) reports putative hybridization between A. brevistyla and A. flavescens in Alberta, Canada.

At Dry Pole (001), initial collections and photographs were taken of a small cluster of A. brevistyla. Upon continuing up the canyon, Aquilegia plants with long blue spurs and sepals were observed in shaded locations, but completely yellow Aquilegias were observed in more open locations. Further exploration up the canyon yielded observations of only A. flavescens.

Subsequently, five more specimen collections were made to include the observed variation of this site, and additional Aquilegia collections were made from surveyed locations across the Lewis & Clark National Forest.

Morphologic measurements were completed on pressed specimens, and sepal color observations were made before collection and after pressing and drying. Only one measurement was taken for each character on each specimen. This information is presented in Table 1, p. 13. Similar information was obtained for Aquilegia specimens collected from other locations on the Forest. Utilizing the keys and descriptions presented by Scoggan (1978), Moss (1983) and Munz (1946), a matrix of characters that are associated with A. brevistyla and A. flavescens was organized in table form, Table 2, p. 14. Individual characters of each specimen were then scored with respect to the matrix (Table 3, p. 15). Thus, the character of sepal color for a specimen was scored as either falling into the description for A. brevistyla or A. flavescens, or if it did not clearly fit into either, (such as yellow when collected, blue when pressed) as intermediate. Finally, a composite score was given to each specimen (bottom of Table 3, p. 15). Collection sites for these specimens are marked on portions of a reduced reproduction of a USDA Forest Service map of the Lewis & Clark National Forest, Figure 2 (p. 16), and 3 (p. 17). Specimens are deposited as detailed under Documentation, Section I.1., p. 20.

Only at Dry Pole (001) was the distribution of A. flavescens actually observed to overlap with A. brevistyla. Six specimens (442 1-6) were collected from this site. Of these, specimens 442-2, and 6 best fit the description of A. brevistyla according to the matrix (Table 2), while specimens 442-3 and -4 fit the description of A. flavescens. Specimens 442-1, and -5 each were given composite scores of intermediate (to A. brevistyla and A. flavescens). Specimen 442-1 had blue sepals, a short style, and stamens that were barely exserted; all characters representative of A brevistyla. However, this specimen also had long and wide sepals, and petals that were less than half the length of the sepals, characters that better fit the description for A. flavescens. Specimen 442-5 was collected yellow but dried

SITE NAME AND NUMBER AND SPECIMEN COLLECTION # / CHARACTER	DRY POLE (001) 442 1	442 2	442 3	442 4	442 5	442 6	BURRIS TRAIL (004) 444 1	444 2	HIGH SPRING CREEK (006) 445 1	S. FORK JUDITH RIVER (011) 446 1	446 2	HAY CANYON (007) 447 1	LOGGING CREEK 448 1	HAYMAKER CANYON 449 1	449 2
SEPAL COLOR: PRIOR TO COLLECTION/ PRESSED AND DRIED	BLUE / BLUE	BLUE / BLUE	YELLOW / YELLOW	RED / RED	YELLOW / BLUE	BLUE / BLUE	BLUE / BLUE	BLUE / BLUE	BLUE / BLUE	BLUE / BLUE	BLUE / BLUE	BLUE / BLUE	YELLOW / YELLOW	YELLOW / YELLOW	YELLOW / BLUE
SEPAL LENGTH (mm)	21	16	16	23	22	14	13	14	15	20	13	15	22	21	17
PETAL/SEPAL RATIO	0.35	0.56	0.25	0.34	0.40	0.57	0.84	0.57	0.60	0.50	0.57	0.60	0.40	0.26	0.47
SEPAL WIDTH (mm)	8	4	7	10	8	5.5	5.5	5	4	9	3	5	8	12	10
PETAL BLADE LENGTH (mm)	7.5	9	4	8	9	8	11	8	9	10	7.5	9	9	5.5	8
STYLE LENGTH (mm)	4	3	7	7	6	4	3.5	3.5	4	6	4.5	4	6.5	6	7
STAMEN POSITION: EXSERTED-(E) BARELY EXSERTED-(BE) INCLUDED-(I)	BE	I	E	E	BE	I	I	I	BE	BE	I	I	E	E	BE

Table 1. Morphological measurements and observations of Aquilegia specimens collected in 1991 from sites in the Little Belt Mountains of Montana.

CHARACTER / SPECIES	Aquilegia brevistyla	Aquilegia flavescens
SEPAL COLOR (fresh/pressed)	blue-bluish purple	yellow (rarely red)
SEPAL LENGTH (mm) PETAL LENGTH/SEPAL LENGTH*	sepals to ca. 16 mm and petal blades better than half as long as sepals	12-22 mm and petal blades less than or equal to half the length of the sepals
SEPAL WIDTH* (mm)	≤ 6 mm	> 6 mm
STYLE LENGTH (mm)	2-5 mm	> 5 mm
STAMENS (INCLUDED-EXSERTED)	stamens = to or barely exceeding petals	stamens much exserted

* Although not described in scientific publications, sepal width and the petal to sepal length ratio appear to separate the species, and are included here.

Table 2. Characters that separate A. brevistyla from A. flavescens (Scoggan 1978, Moss 1983, and Munz 1946).

SITE NAME AND NUMBER AND SPECIMEN COLLECTION # / CHARACTER	DRY POLE (001) 442 1	442 2	442 3	442 4	442 5	442 6	BURRIS TRAIL (004) 444 1	444 2	HIGH SPRING CREEK (006) 445 1	S. FORK JUDITH RIVER (011) 446 1	446 2	HAY CANYON (007) 447 1	LOGGING CREEK 448 1	HAYMAKER CANYON 449 1	449 2
SEPAL COLOR	B	B	F	F	I	B	B	B	B	B	B	B	F	F	I
SEPAL LENGTH, AND PETAL TO SEPAL LENGTH RATIO	F	B	F	F	F	B	B	B	B	F	B	B	F	F	F
SEPAL WIDTH	F	B	F	F	F	B	B	B	B	F	B	B	F	F	F
STYLE LENGTH	B	B	F	F	F	B	B	B	B	F	B	B	F	F	F
STAMEN POSITION	B	B	F	F	B	B	B	B	B	B	B	B	F	F	B
COMPOSITE SCORE OF CHARACTERS FOR EACH SPECIMEN	I	B	F	F	I	B	B	B	B	I	B	B	F	F	I

B = This character or specimen best fit the description for A. brevistyla.
F = This character or specimen best fit the description for A. flavescens.
I = This character or specimen was intermediate to the description for A. brevistyla or A. flavescens.

Table 3. Character states, and a composite score for each specimen, according to the matrix of characters used to separate A. brevistyla from A. flavescens (see Tables 1, p.13 & 2, p.14).

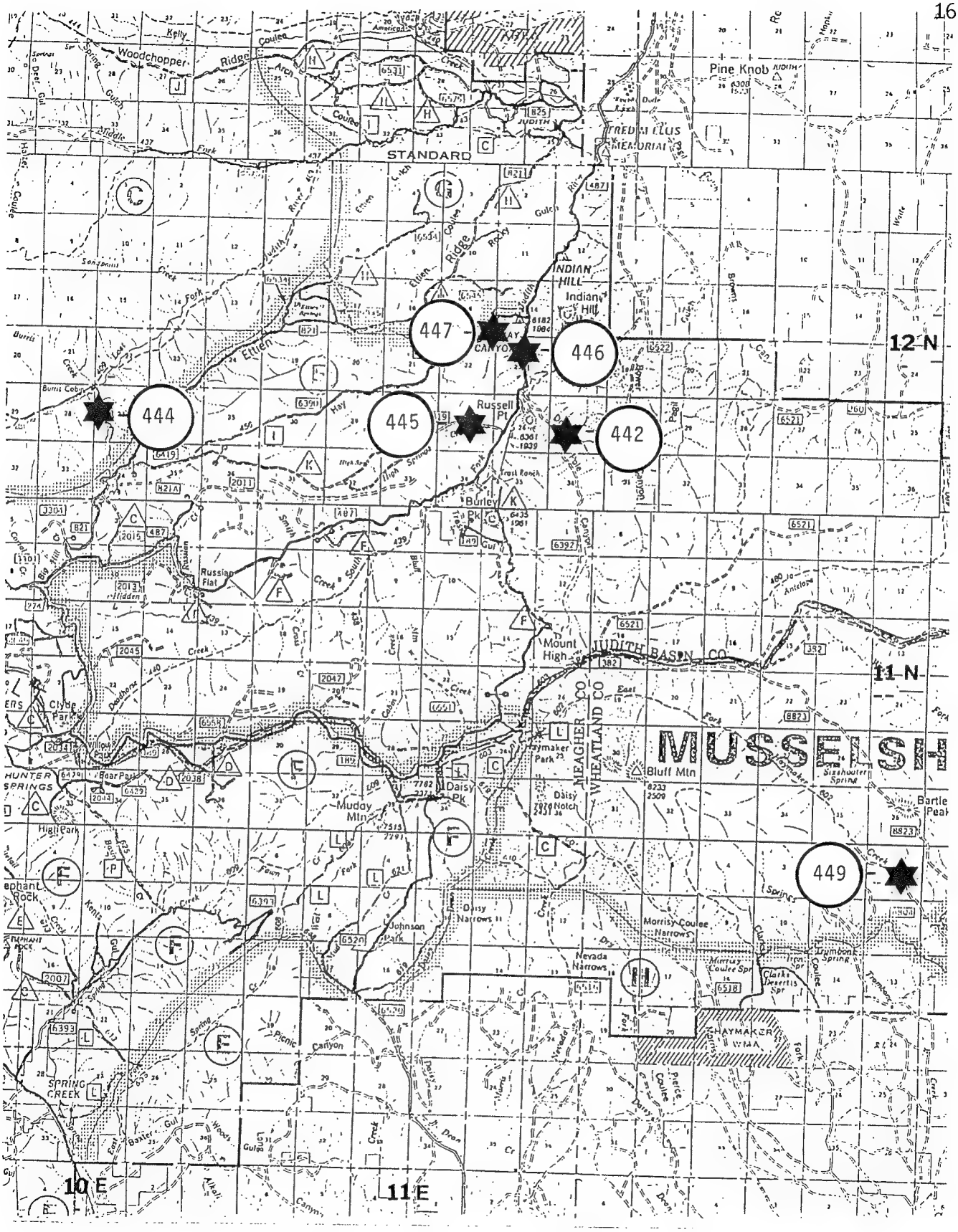


Figure 2. USDA Lewis & Clark National Forest map showing the locations ★ of the Aquilegia collections on which measurements (Table 1) were made in 1991. Specimen collection numbers occur next to the stars above, and in Table 1.

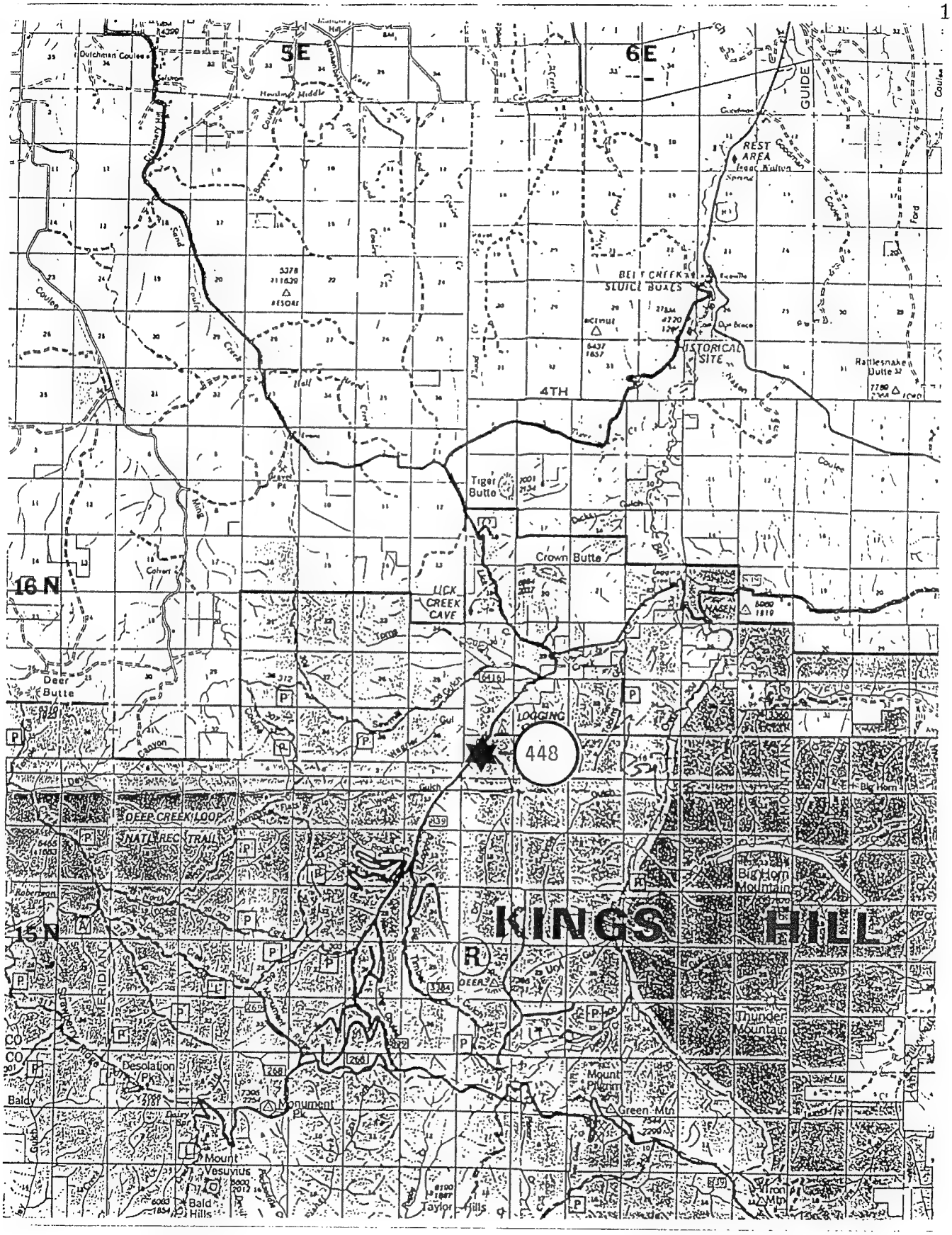


Figure 3. USDA Lewis & Clark National Forest map showing the location ★ of an Aquilegia collection on which measurements (Table 1) were made in 1991. A specimen collection number occurs next to the star above, and in Table 1.

blue, and had barely exserted stamens. All other characters for this specimen fit the description for A. flavescens. A photograph of a putative hybrid plant is included in Section VI, p. 47.

Although A. flavescens was not observed near the South Fork Judith River (011) population, specimen 446-1 had blue sepals and barely exserted stamens, characters that best fit the description of A. brevistyla. However, it also had long and wide sepals, and a long style, characters associated with A. flavescens. Due to the mix of characters, this specimen was also scored as an intermediate.

Other puzzling collections include those from Haymaker Canyon on the southeast side of the Little Belt Mountains. When these two specimens were collected, both were yellow in color. One of the two (449-2) dried to blue, and the stamens on this specimen were also barely exserted; characters associated with A. brevistyla. All the other characters for both specimens however better fit the matrix for A. flavescens. No blue Aquilegia were observed nearby.

In light of this situation, a chromosome count and electrophoretic analysis would be of use in discerning the status of these questionable populations.

Asexual reproduction is virtually non-existent in the wild, but in cultivation, root division is possible (Munz 1946).

b. **POLLINATION BIOLOGY:** Not known.

c. **SEED DISPERSAL AND BIOLOGY:** Under cultivation, species in the genus Aquilegia do well in light sandy soil, and may be seeded in early spring or summer. Most species in the genus appear to live only 3-4 years under cultivation, although this time period may be further prolonged by prevention of seed production (Munz 1946).

   Seed appears to disperse by wind in August or September when the follicles dry and dehisce.

d. **FIRE ECOLOGY:** A fire swept through the Sage Creek drainage in the fall of 1990. A portion of the A. brevistyla population (Sage Creek (003)) was in an area that burned.

This area was resurveyed for A. brevistyla by Wayne Phillips (Lewis & Clark National Forest) during the summer of 1991. Where the fire burned away the duff layer, A. brevistyla plants did not survive. However, if the duff layer was still intact, the root crown was apparently protected, and basal leaves appeared in 1991. Plants in very lightly burned areas not only survived, but many flowered in 1991 (Phillips 1991). Although precautions were made, a salvage timber sale may eliminate portions of what is left of the surviving plants. It is also not known how the loss of shade will affect the population. Several stakes were set in 1991 by Lewis & Clark National Forest personnel. These marked the location of groups of suspected vegetative A. brevistyla plants. These stake areas should be resurveyed in 1992, and the entire area reviewed for several years to make general observations on this species response to fire.

G. POPULATION ECOLOGY

1. BIOLOGICAL INTERACTIONS

a. COMPETITION: Aquilegia brevistyla plants were observed to occur where total understory vegetation cover may reach 90 percent; they appear to compete very well. Partial overstory shade was common, and only a few plants were observed in more open locations at the edges of meadows. Often these more open sites would receive shade from the adjacent forest and steep ridges.

b. HERBIVORY: None observed.

H. LAND OWNERSHIP

1. Lewis & Clark National Forest
Judith Ranger District

Dry Pole (001)
Sage Creek (003)
Burris Trail (004)
Burley Creek (005)
High Spring Creek (006)
Hay Canyon (007)
South Fork Judith River (008)
South Fork Judith River (009)
Smith Creek (010)

2. Gallatin National Forest
Big Timber Ranger District

Boulder River (002)

I. DOCUMENTATION

1. **SPECIMENS:** Specimens documenting populations are deposited at the University of Montana Herbarium (MONTU), Montana State University (MONT), and at the U.S. Forest Service, Region 1 Herbarium (MRC). Locations of specimens of A. flavescens collected and used for reference material are included below.

Aquilegia brevistyla

Dry Pole (001)
Lovaas, A. (s.n.), 1956, Specimen #51788 (MONT).

Dry Pole (001)
Roe, L.S. (442-1,2,3,4,5,6), 1991, (MONT). Specimen 442-2,and -5 showed characters intermediate to A. brevistyla and A. flavescens.

Boulder River (002)
Thornton, L. (s.n.), 1967, (MONT). R. Dorn, "specimen questionable probably A. coerulea James." S. Shelly, "measurements unsure."

Sage Creek (003)
Phillips, H.W. (900629-1), 1990, (MONTU).

Burris Trail (004)
Field, D. (070490-2), 1990.

Roe, L.S. (444-1,2), 1991, (MONTU).

High Spring Creek (006)
Roe, L.S. (445), 1991, (MONT).

Hay Canyon (007)
Roe, L.S. (447), 1991, (MONT).

South Fork Judith River (008)
Roe, L.S. (446-1,2), 1991, (MONT). Specimen 446-1, and -2 showed characters intermediate to A. brevistyla and A. flavescens.

Aquilegia flavescens

Logging Creek
Roe, L.S. (448), 1991, (MONT).

Haymaker Canyon
Roe, L.S. (449-1,2), 1991, (MONT). Specimen 449-2 showed characters intermediate to A. brevistyla and A. flavescens.

2. **SLIDES:** Color slides of individuals, populations, and the habitat of A. brevistyla are deposited at the Montana Natural Heritage Program, 1515 E. 6th Ave., Helena, MT.

III. ASSESSMENT AND MANAGEMENT RECOMMENDATIONS

A. THREATS TO CURRENTLY KNOWN POPULATIONS:

1. **GRAZING:** The Sage Creek (003) and Dry Pole (001) populations are in grazing allotments. Grazing impacts should be evaluated, especially for the Sage Creek area where much of the forage burned. This site was rested during 1991, but will be grazed at the previous level in 1992. The effects of grazing should be noted where possible.

2. **TIMBER HARVESTING:** As stated above, although precautions may be taken, timber harvest is likely to affect a portion of the remaining plants at Sage Creek (003). Aquilegia brevistyla also occurs in several areas proposed for timber sale along the South Fork of the Judith River, and these activities should be reviewed for their effect on these populations.

3. **WEED CONTROL ACTIVITIES:** Many of the A. brevistyla populations would be susceptible to weed control activities due to their proximity to roadways. Weed control management teams should be aware of the presence of A. brevistyla populations on the Lewis & Clark National Forest.

4. **ROAD BUILDING:** Aquilegia brevistyla plants have been found to invade old road cuts in both Hay Canyon (007) and Burley Creek (005). Although disturbance does not appear to be necessary for this species' survival, A. brevistyla does appear able to invade and establish itself in disturbed areas. If this species is able to invade disturbed areas, skid trails and roads used in

logging operations in Sage Creek should be observed in the future.

B. **MANAGEMENT PRACTICES AND RESPONSE:** None known.

C. **RECOMMENDATIONS FOR MAINTAINING VIABLE POPULATIONS:** Little is known of the habitat requirements of this species. Until further information is gained, all populations should receive protection from management actions that might degrade the habitat and affect the populations.

D. **RECOMMENDATIONS FOR FURTHER ASSESSMENT:** An electrophoretic analysis of populations of A. brevistyla and A. flavescens could prove useful in discerning whether or not hybridization is occurring. Also, a chromosome count on several populations would be useful in verifying the work done by Dawe and Murray (1981).

Post-fire observations should be continued at Sage Creek (003) to determine this species' long term response to fire. Further survey work in the Judith River watershed would better define the boundaries of this meta-population. Finally, another attempt should be made to verify the location on the Boulder River (002), Gallatin National Forest.

VI. LITERATURE CITED

Achuff, P.L. 1991. Plant species of special concern in Montana. Montana Natural Heritage Program, Helena, Montana. 20 pp., mimeo.

Clausen, J., D. Keck, and W. Heisey. 1945. Experimental studies on the nature of species. Carnegie Inst. Publ. 564: 77-79.

Dawe, J.C., and D.F. Murray. 1981. Chromosome numbers of selected Alaskan vascular plants. Canadian Journal of Botany 59:1373-1381.

DeSanto, J. 1991. Variations in Aquilegia jonesii. Bulletin of the American Rock Garden Society 49(1):60-65.

Dorn, R. D. 1984. Vascular plants of Montana. Mountain West Publishing. 276 pp.

Hitchcock, C.L., Cronquist A., Ownbey, M. and J.W. Thompson. 1964. Vascular plants of the Pacific Northwest, Part 2: Salicaceae to Saxifragaceae. University of Washington Press, Seattle. 597 pp.

Lesica, P., and J.S. Shelly. 1991. Sensitive, Threatened and Endangered Plants of Montana. Montana Natural Heritage Program, Occasional Publication No. 1. Helena, Montana. 88 pp.

Marriott, H. 1991. Plant species of special concern in Wyoming. Wyoming Natural Diversity Data Base, Laramie, Wyoming. 7 pp., mimeo.

Moss, E.H. 1983. Flora of Alberta. 2nd edition revised by J.G. Packer. University of Toronto Press, Canada. 687 pp.

Munz, P.A. 1946. Aquilegia, the cultivated and wild columbines. Gentes Herbarium 7:1-150.

Ode, D. 1991. South Dakota Natural Heritage Program Botanist, Pierre, South Dakota. Phone conversation (September) on the distribution of Aquilegia brevistyla in South Dakota.

Phillips, H.W. 1991. Lewis & Clark National Forest Ecologist, Great Falls, Montana. Phone conversations of December 4 and 5, on fire ecology and distribution of A. brevistyla.

Scoggan, H.J. 1978. The flora of Canada. Part 3. National Museums of Canada, Ottawa, Canada. pp. 547-1115.

Strickler, D. 1991. A native columbine hybrid: Aquilegia X elatior. Kelseya, Newsletter of the Montana Native Plant Society 4(3):5.

U.S. Department of Commerce. 1982. Monthly normals of temperature, precipitation, and heating and cooling degree days 1951-80. National Oceanic and Atmospheric Administration, Climatography of the United States No. 81. 23 pp.

Weed, W.H. 1899. Description of the Little Belt Mountains, Montana. USGS Geology Atlas. Folio 56, map 1:250,000.

V. ELEMENT OCCURRENCE PRINT-OUTS AND MAPS

Note: On maps, dark lines outline population boundaries, the dot is used only as a locator for the site occurrence numbers.

Montana Natural Heritage Program
Element Occurrence Record: Aquilegia brevistyla

Occurrence number: 001

Global rank: G5 Forest Service status: SENSITIVE
State rank: S1 Federal Status:

Survey site name: DRY POLE
EO rank: C
EO rank comments: POSSIBLE HYBRIDIZATION WITH AQUILEGIA FLAVESCENS.

County: JUDITH BASIN

USGS quadrangle: INDIAN HILL

Township: 012N Range: 011E Section: 25 Precision: S
Township-range comments: SW4

Survey date: 1991-07-01 Elevation: 5520
First observation: 1956 Slope/aspect: LEVEL-5% / SW, NE
Last observation: 1991-07-01 Size (acres): 1

Location:
LITTLE BELT MOUNTAINS; TAKE THE SOUTH FORK JUDITH RIVER ROAD (DRY POLE CANYON) CA. 16 MILES SOUTHWEST OF UTICA.

Element occurrence data:
CA. 45 PLANTS IN TWO MAIN SUBPOPULATIONS, AND SEVERAL SCATTERED PLANTS. PLANTS FURTHER UP THE CANYON HAVE CHARACTERISTICS INTERMEDIATE BETWEEN AQUILEGIA BREVISTYLA AND AQUILEGIA FLAVESCENS.

General site description:
ECOTONAL TO PSEUDOTSUGA MENZIESII (13-14" DBH) / PINUS CONTORTA FOREST. ASSOCIATED WITH FRAGARIA VIRGINIANA, GALIUM BOREALE, POTENTILLA FRUTICOSA, ANTENNARIA RACEMOSA, ARCTOSTAPHYLOS UVA-URSI, SMILACINA STELLATA, HABENARIA VIRIDIS AND LINNAEA BOREALIS. SITE IS PARTIALLY SHADED BY VEGETATION AND PARTIALLY BY ITS CANYON BOTTOM POSITION. CALCAREOUS ROCKY SOILS WITH A THICK DUFF AND MOSS LAYER; MOIST SITE.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, JUDITH RANGER DISTRICT

Comments:
ORIGINAL DATA FROM SPECIMEN: LOVAAS, A. (S.N.) 1956, SPECIMEN # 51788, MONT. SOUTH OF LAST MAPPED SUBPOPULATION PLANTS SHOWED CHARACTERISTICS INTERMEDIATE BETWEEN AQUILEGIA BREVISTYLA AND AQUILEGIA FLAVESCENS. CA. 0.5 MILE BEYOND THAT, ALL PLANTS SHOWED CHARACTERS OF AQUILEGIA FLAVESCENS.

Information source:
ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 EAST SIXTH AVE., HELENA, MT 59620 (442, 1-6) 1991. MONT.

Occurrence number: 002

Global rank: G5 Forest Service status: SENSITIVE
State rank: S1 Federal Status:

Survey site name: BOULDER RIVER
EO rank:
EO rank comments:

County: SWEET GRASS

USGS quadrangle: CHROME MOUNTAIN

Township: 005S Range: 012E Section: 01 Precision: G
Township-range comments:

Survey date:
First observation: 1967
Last observation: 1967-07-04

Elevation: 5560
Slope/aspect:
Size (acres):

Location:
BOULDER RIVER, 20 MILES ABOVE THE TOWN OF MCLEOD (GENERAL LOCATION).

Element occurrence data:
IN FRUIT.

General site description:
UNKNOWN.

Land owner/manager:
GALLATIN NATIONAL FOREST, BIG TIMBER RANGER DISTRICT

Comments:
IDENTIFICATION IS QUESTIONABLE; R. DORN: "PROBABLY A. COERULEA JAMES"; A. PLANTENBERG, 1983: "NO"; S. SHELLY, "FLORAL MEASUREMENTS INCONCLUSIVE." GENERAL LOCATION; S. MATHEWS, PLANT PRESSED SUCH THAT FLOWERS CANNOT BE PROPERLY MEASURED; SURVEYS 28-30 JULY 1989, BY S. MATHEWS, NO A. BREVISTYLA OR A. COERULEA FOUND.

Information source:
THORNTON, L. (S.N.). 1967. MONT.

Occurrence number: 003

Global rank: G5 Forest Service status: SENSITIVE
State rank: S1 Federal Status:

Survey site name: SAGE CREEK
EO rank: D
EO rank comments: GRAZING IN AREA, BURNED IN 1990, LOGGING IN 1991.

County: JUDITH BASIN

USGS quadrangle: WOODHURST MOUNTAIN

Township: 014N Range: 011E Section: 21 Precision: S
Township-range comments: S2,SW4NW4,22W2,29SE4NE4,20NW4NE4,17SW4SE4

Survey date: 1991-06-29 Elevation: 5600
First observation: 1990 Slope/aspect: 0-8% / NORTH, EAST
Last observation: 1991-06-29 Size (acres): 4

Location:
CA. 2.5 MILES SOUTHWEST OF WINDHAM, ALONG SAGE CREEK (FS ROAD #265).

Element occurrence data:
1991: SITE BURNED IN THE FALL OF 1990, ca. 750-1000 plants. 1990: ca. 2000 PLANTS IN FLOWER AND FRUIT; VERY DISTINCT BLUE SEPALS AND SHORT HOOKED SPURS. SCATTERED INDIVIDUALS UP HAY COULEE. SUBPOPULATIONS AT AND ABOVE HAY COULEE ALONG SAGE CREEK ARE STILL PRESENT AND ABOUT HALF IN FLOWER; PLANTS IN SECTION 22 MAY BE GONE.

General site description:
ECOTONE BETWEEN ENGELMANN SPRUCE/DOUGLAS FIR FOREST AND FESTUCA SCABRELLA/POA PRATENSIS MEADOWS. ALLUVIAL AND COLLUVIAL LIMESTONE SUBSTRATE. ASSOCIATED SPECIES: LINNAEA BOREALIS, JUNIPERUS COMMUNIS, ARNICA CORDIFOLIA, ARCTOSTAPHYLOS UVA-URSI, PYROLA SECUNDA, PHLEUM PRATENSE, FESTUCA SCABRELLA. MUCH OF THE OVERSTORY BURNED IN THE FALL OF 1990.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, JUDITH RANGER DISTRICT

Comments:
1991: AFTER THE FIRE, PLANTS WERE STILL PRESENT WHERE THE DUFF DID NOT BURN. 1990: POPULATION PROBABLY EXTENDS UP HAY COULEE AND SAGE CREEK.

Information source:
PHILLIPS, WAYNE. LEWIS AND CLARK NATIONAL FOREST, P.O. BOX 871, GREAT FALLS, MT 59403. (900629-1). 1990. MONTU.

Montana Natural Heritage Program
Element Occurrence Record: Aquilegia brevistyla

Occurrence number: 004

Global rank: G5 Forest Service status: SENSITIVE
State rank: S1 Federal Status:

Survey site name: BURRIS TRAIL
EO rank: B
EO rank comments: SMALL POPULATION, BUT GOOD REMOTE LOCATION.

County: JUDITH BASIN

USGS quadrangle: ETTIEN SPRING

Township: 012N Range: 010E Section: 27 Precision: S
Township-range comments: SW4NW4

Survey date: 1991-07-02 Elevation: 6020
First observation: 1990 Slope/aspect: 8-15% / NORTHWEST
Last observation: 1991-07-02 Size (acres): 1

Location:
CA. 18 MILES SOUTHEAST OF NEIHART; CA. 0.5 MILE SOUTH OF BURRIS CABIN ON FS TRAIL #433.

Element occurrence data:
1991: CA. 100 PLANTS IN FULL BLOOM ON 2 JULY (WET, COLD MAY AND JUNE).
1990: A FEW PLANTS, BLOOM NEARLY FINISHED 4 JULY.

General site description:
ALONG TRAIL; ALL FORESTED, CA. 50% CANOPY CLOSURE. ASSOCIATED SPECIES: PINUS CONTORTA, ABIES LASIOCARPA, PSEUDOTSUGA MENZIESII, THALICTRUM OCCIDENTALE, CALAMAGROSTIS RUBESCENS, ASTER CONSPICUUS, CYPRIPEDIUM MONTANUM, LINNAEA BOREALIS, GALIUM BOREALE, ANTENNARIA RACEMOSA, VIOLA CANADENSIS, AND EXTENSIVE MOSS COVER.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, JUDITH RANGER DISTRICT

Comments:
POPULATION COVERS SMALL AREA FROM TRAIL WEST TO CREEK. VOUCHER - FIELD, D. (070490-2), 1990.

Information source:
ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 EAST 6TH AVE., HELENA, MT 59620. (444). 1991. MONT.

Montana Natural Heritage Program
Element Occurrence Record: Aquilegia brevistyla

Occurrence number: 005

Global rank: G5 Forest Service status: SENSITIVE
State rank: S1 Federal Status:

Survey site name: BURLEY CREEK
EO rank:
EO rank comments:

County: JUDITH BASIN

USGS quadrangle: INDIAN HILL

Township: 012N Range: 011E Section: 35 Precision: S
Township-range comments: NW4,26CENTRAL.

Survey date: 1991-08 Elevation: 5800
First observation: 1991 Slope/aspect: 0-30% / NNW
Last observation: 1991-08 Size (acres): 300

Location:
LITTLE BELT MOUNTAINS; CA. 2 AIR MILES SOUTH OF DRY POLE CAMPGROUND. SITE IS EAST OF THE SOUTH FORK JUDITH RIVER, ALONG THE BOTTOM OF THE RIDGE.

Element occurrence data:
SEVERAL THOUSAND INDIVIDUALS; FULL FLOWER TO PAST FLOWER.

General site description:
PLANTS SCATTERED OVER A LARGE AREA. SEMI-OPEN, MOIST DRAINAGE BOTTOMS AND LOWER SLOPES, LIMESTONE BEDROCK, SILTY CLAY LOAM SOIL. PSEUDOTSUGA MENZIESII/SYMPHORICARPOS ALBUS, PSEUDOTSUGA MENZIESII/LINNAEA BOREALIS, AND PICEA ENGELMANNII/LINNAEA BOREALIS HABITAT TYPES. PINUS PONDEROSA, SHEPHERDIA CANADENSIS, JUNIPERUS COMMUNIS, SPIRAEA BETULIFOLIA, GERANIUM RICHARDSONII, FESTUCA IDAHOENSIS, POA SPP., HYLOCOMIUM SPLENDENS, PLEUROZIUM SCHREBERI, DREPANOCLADUS UNCINATUS, TIMMIA AUSTRIACA, AND THUIDIUM ABIETINUM. ALSO GOODYERA REPENS. LIST OF ADDITIONAL SPECIES ON FILE AT MTNHP.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, JUDITH RANGER DISTRICT

Comments:
ALONG BURLEY CREEK, PLANTS OCCUR ALONGSIDE OLD, REVEGETATED ROADWAY ACCESSING A SMALL TIMBER HARVEST. SURVEY CONDUCTED BY ROGER EVANS. LATER SURVEY WORK BY WAYNE PHILLIPS EXTENDED POPULATION BOUNDARIES.

Information source:
PHILLIPS, H. WAYNE, LEWIS AND CLARK NATIONAL FOREST, P.O.BOX 871, GREAT FALLS, MT 59403.

Montana Natural Heritage Program
Element Occurrence Record: Aquilegia brevistyla

Occurrence number: 006

Global rank: G5 Forest Service status: SENSITIVE
State rank: S1 Federal Status:

Survey site name: HIGH SPRING CREEK
EO rank: A
EO rank comments: EXCELLENT POPULATION.

County: JUDITH BASIN

USGS quadrangle: INDIAN HILL

Township: 012N Range: 011E Section: 27 Precision: S
Township-range comments: CENTER

Survey date: 1991-07-02 Elevation: 5600
First observation: 1991 Slope/aspect: 0-40% / NORTH
Last observation: 1991-07-02 Size (acres): 30

Location:
LITTLE BELT MOUNTAINS, HIGH SPRING CREEK, NEAR THE SOUTH FORK JUDITH RIVER, CA. 17 MILES SOUTHWEST OF UTICA.

Element occurrence data:
100-200 PLANTS, SCATTERED.

General site description:
IN CALCAREOUS ROCKY SOILS WITHIN AND AT MARGINS OF PSEUDOTSUGA MENZIESII AND PINUS CONTORTA FOREST. IN FEATHERMOSS, WITH CLEMATIS COLUMBIANA, LINNAEA BOREALIS, ANTENNARIA RACEMOSA, SMILACINA STELLATA, AND POTENTILLA FRUTICOSA.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, JUDITH RANGER DISTRICT

Comments:
NO AQUILEGIA FLAVESCENS PRESENT.

Information source:
ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 EAST 6TH AVE., HELENA, MT 59620. (445). 1991. MONT.

Montana Natural Heritage Program
Element Occurrence Record: Aquilegia brevistyla

Occurrence number: 007

Global rank: G5 Forest Service status: SENSITIVE
State rank: S1 Federal Status:

Survey site name: HAY CANYON
EO rank: B
EO rank comments: LARGE POPULATION, NOT EASILY PROTECTED.

County: JUDITH BASIN

USGS quadrangle: INDIAN HILL

Township: 012N Range: 011E Section: 14 Precision: S
Township-range comments: N2SW4;15SE4;22NW4NE4.

Survey date: 1991-07-03 Elevation: 5200
First observation: 1991 Slope/aspect: 0-30% / N, S, W
Last observation: 1991-07-03 Size (acres): 40

Location:
LITTLE BELT MOUNTAINS, HAY CANYON NEAR THE SOUTH FORK JUDITH RIVER, CA. 14 MILES SOUTHWEST OF UTICA.

Element occurrence data:
800-1000 STEMS.

General site description:
PLANTS SCATTERED ALONG CANYON BOTTOM AND ROADSIDE, IN CALCAREOUS, ROCKY SOILS. PSEUDOTSUGA MENZIESII/PINUS CONTORTA FOREST, WITH CLEMATIS COLUMBIANA, LINNAEA BOREALIS, ARCTOSTAPHYLOS UVA-URSI, GALIUM BOREALE AND FRAGARIA VIRGINIANA.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, JUDITH RANGER DISTRICT

Comments:
PORTIONS OF POPULATION IN DISTURBED HABITATS (ROADSIDE GRAVELS).

Information source:
ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. SIXTH AVE., HELENA, MT 59620. (447) 1991. MONT.

Montana Natural Heritage Program
Element Occurrence Record: Aquilegia brevistyla

Occurrence number: 008

Global rank: G5 Forest Service status: SENSITIVE
State rank: S1 Federal Status:

Survey site name: SOUTH FORK JUDITH RIVER
EO rank: C
EO rank comments: SMALL POPULATION; ROADSIDE.

County: JUDITH BASIN

USGS quadrangle: INDIAN HILL

Township: 012N Range: 011E Section: 01 Precision: S
Township-range comments: NE4SW4

Survey date: 1991-07-03 Elevation: 5040
First observation: 1991 Slope/aspect: 0-5% / WEST
Last observation: 1991-07-03 Size (acres): 1

Location:
LITTLE BELT MOUNTAINS, SOUTH FORK JUDITH RIVER, CA. 14 MILES SOUTHWEST OF UTICA, ON BENCH ON EAST SIDE OF ROAD.

Element occurrence data:
10-15 PLANTS.

General site description:
CANYON BOTTOM, IN ROCKY CALCAREOUS SOILS BENEATH PSEUDOTSUGA MENZIESII AND PINUS CONTORTA, WITH CLEMATIS COLUMBIANA, JUNIPERUS COMMUNIS, LINNAEA BOREALIS AND ARNICA CORDIFOLIA, ACER GLABRUM, ARCTOSTAPHYLOS UVA-URSI AND GOODYERA REPENS.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, JUDITH RANGER DISTRICT

Comments:
NONE.

Information source:
ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. SIXTH AVE., HELENA, MT 59620.

Montana Natural Heritage Program
Element Occurrence Record: Aquilegia brevistyla

Occurrence number: 009

Global rank: G5 Forest Service status: SENSITIVE
State rank: S1 Federal Status:

Survey site name: SOUTH FORK JUDITH RIVER
EO rank: C
EO rank comments: POPULATION MAY CONTAIN HYBRIDS.

County: JUDITH BASIN

USGS quadrangle: INDIAN HILL

Township: 012N Range: 011E Section: 23 Precision: S
Township-range comments: CENTER

Survey date: 1991-07-02 Elevation: 5240
First observation: 1991 Slope/aspect: 0-20% / NORTHEAST
Last observation: 1991-07-02 Size (acres): 1

Location:
LITTLE BELT MOUNTAINS; SOUTH FORK JUDITH RIVER, CA. 0.5 MILE NORTH OF RUSSELL POINT, ON WEST SIDE OF RIVER WHERE A SMALL CREEK FLOWS INTO THE SOUTH FORK.

Element occurrence data:
CA. 25 PLANTS. POPULATION MAY CONTAIN HYBRIDS.

General site description:
IN ROCKY CALCAREOUS SOIL, IN SHADED LOCATION, GROUND COVERED BY FEATHERMOSS, WITH CLEMATIS COLUMBIANA, LINNAEA BOREALIS, PSEUDOTSUGA MENZIESII AND JUNIPERUS COMMUNIS.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, JUDITH RANGER DISTRICT

Comments:
TWO COLLECTIONS: ONE KEYS EASILY TO A. BREVISTYLA, THE SECOND SHOWS CHARACTERS INTERMEDIATE BETWEEN A. BREVISTYLA AND A. FLAVESCENS.

Information source:
ROE, LISA, S., MONTANA NATURAL HERITAGE PROGRAM, 1515 E 6TH AVE. HELENA, MT 59620. (466-1,2). 1991. MONT.

Montana Natural Heritage Program
Element Occurrence Record: Aquilegia brevistyla

Occurrence number: 010

Global rank: G5 Forest Service status: SENSITIVE
State rank: S1 Federal Status:

Survey site name: SMITH CREEK
EO rank:
EO rank comments:

County: JUDITH BASIN

USGS quadrangle: RUSSIAN FLAT
DAISY PEAK

Township: 011N Range: 011E Section: 8 Precision: S
Township-range comments: NW4SW4

Survey date:
First observation: 1991
Last observation: 1991-07-18

Elevation: 5880
Slope/aspect: 30 % / NORTHEAST
Size (acres): 1

Location:
LITTLE BELT MOUNTAINS; FROM UTICA, FOLLOW THE SOUTH FORK JUDITH RIVER CA. 21 MILES SOUTHWEST TO THE INTERSECTION WITH SMITH CREEK. SITE IS CA. 0.12 MILE UP SMITH CREEK FROM THE CONFLUENCE.

Element occurrence data:
TWO PLANTS, PAST FLOWER.

General site description:
ON MESIC, LIMEY SHALE OUTCROP, IN PARTIAL SHADE OF A LOWER SLOPE. PICEA ENGELMANNII/LINNAEA BOREALIS, WITH: THALICTRUM OCCIDENTALE, ATHYRIUM FILIX-FEMINA, GALIUM TRIFLORUM, RIBES LACUSTRE, ACER GLABRUM, FEATHER MOSSES AND CALYPSO BULBOSA.

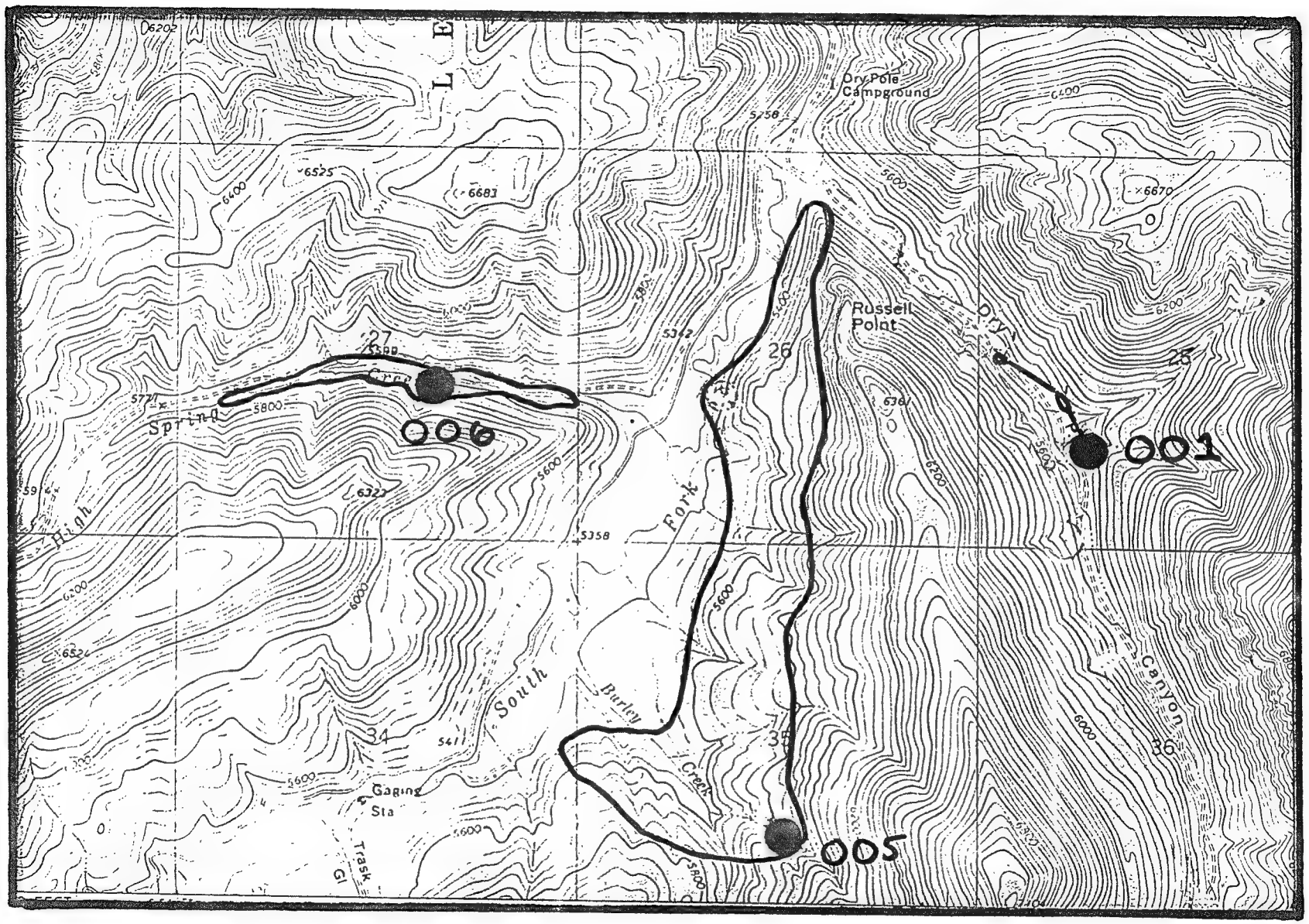
Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, JUDITH RANGER DISTRICT

Comments:
PLANTS WERE IDENTIFIED ON THE BASIS OF SHORT-STYLED CAPSULES; COLLECTIONS NEED TO BE MADE IN FLOWER FOR POSITIVE IDENTIFICATION.

Information source:
FIELD, DANA, LEWIS AND CLARK NATIONAL FOREST, BOX 869, GREAT FALLS, MT 59403.

Montana

USGS Indian Hill (7.5') Quadrangle

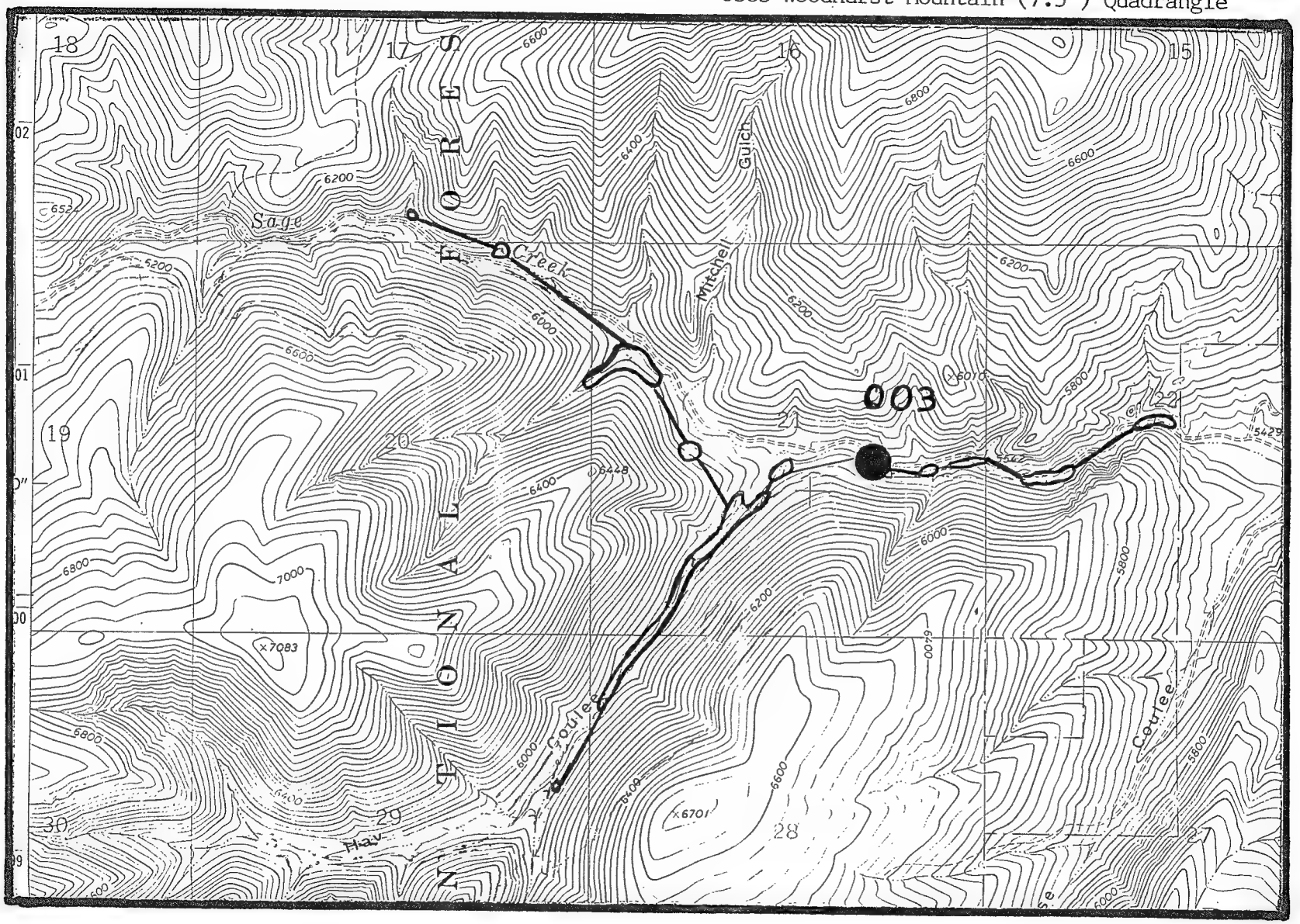


Aquilegia brevistyla

Dry Pole (001)
Burley Creek (005)
High Spring Creek (006)

Montana

USGS Woodhurst Mountain (7.5') Quadrangle

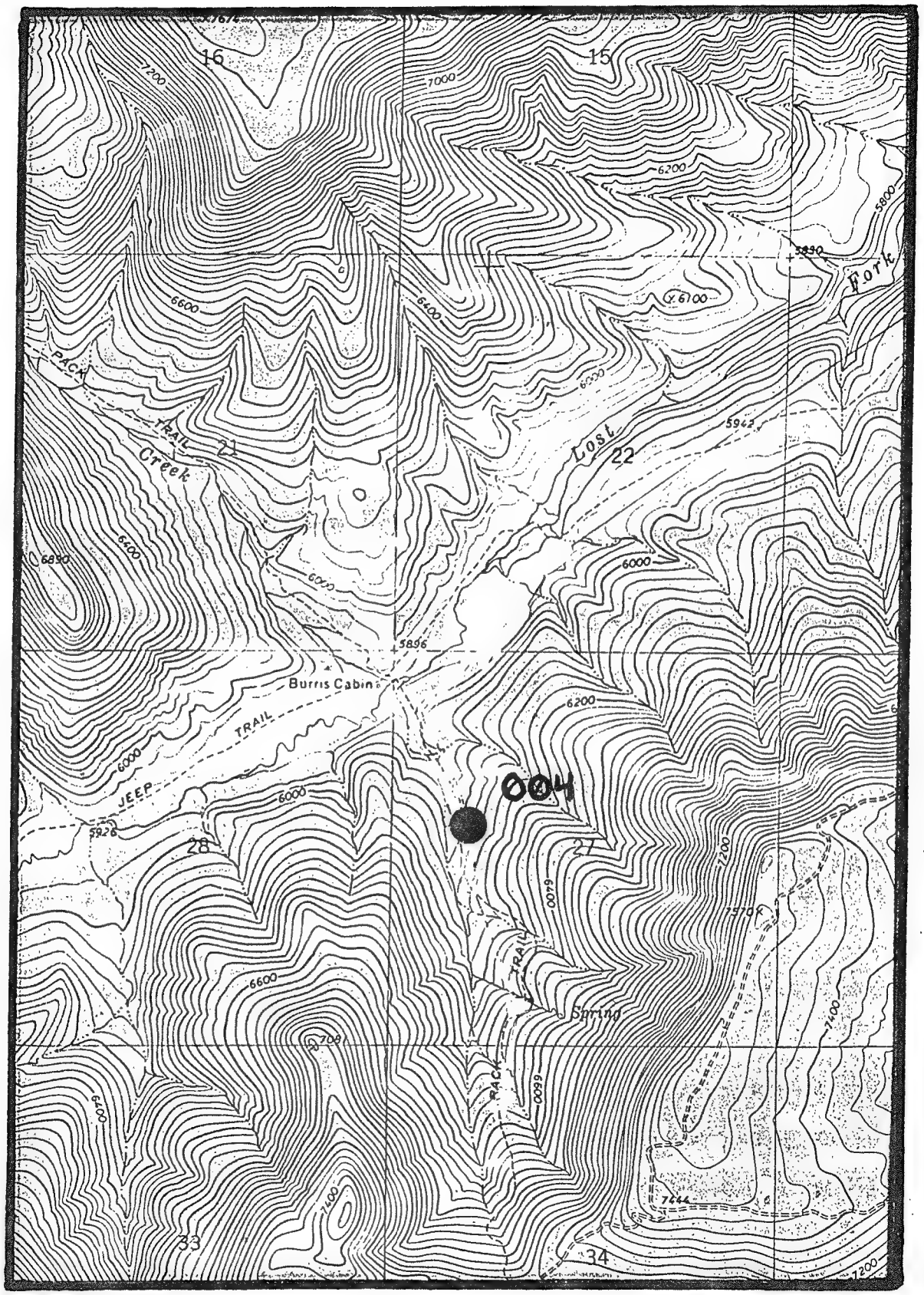


Aquilegia brevistyla

Sage Creek (003)

* Subpopulations furthest to the east may be much reduced as a result of the 1990 fire.

Montana USGS Ettien Spring (7.5') Quadrangle

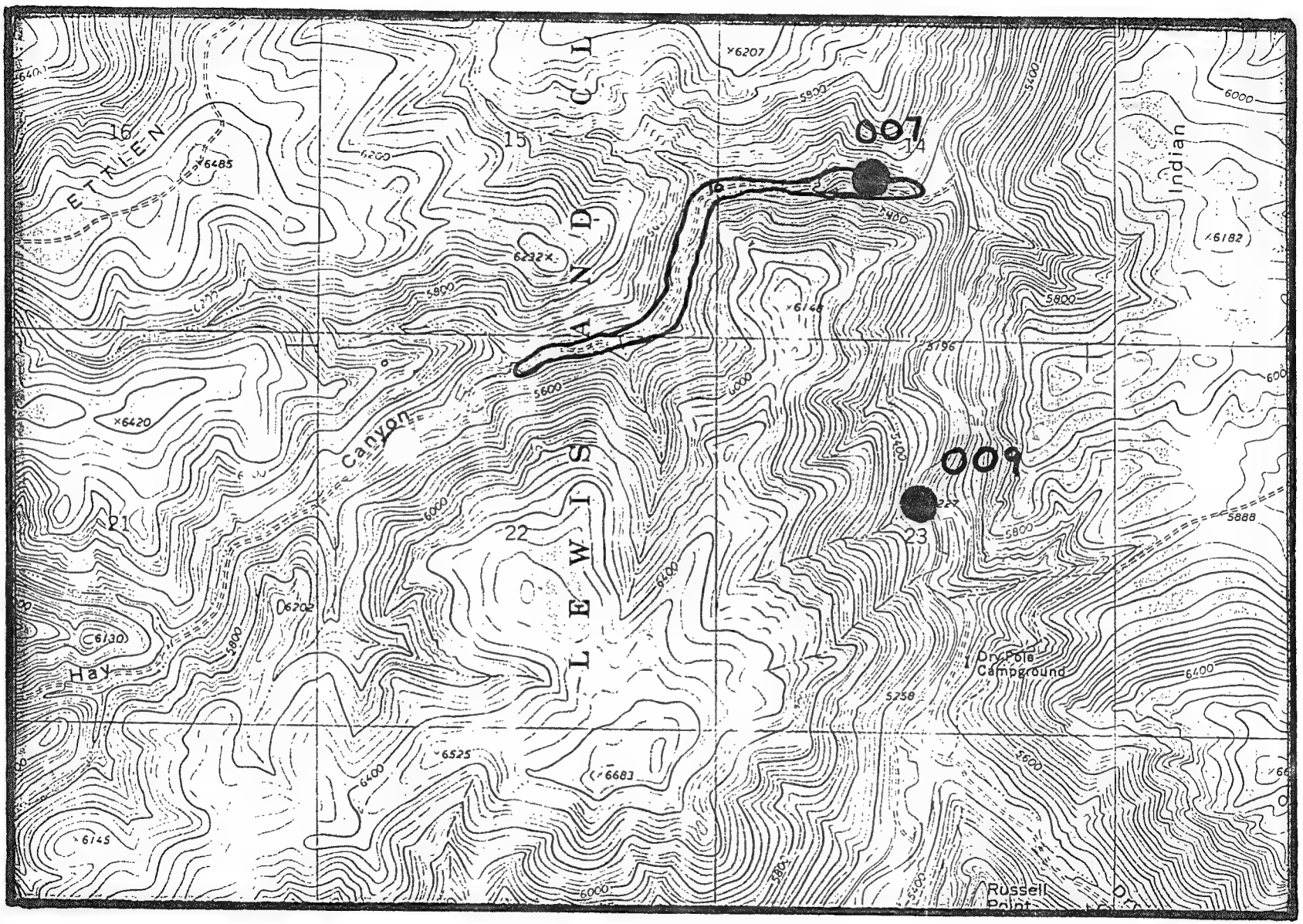


Aquilegia brevistyla

Burris Trail (004)

Montana

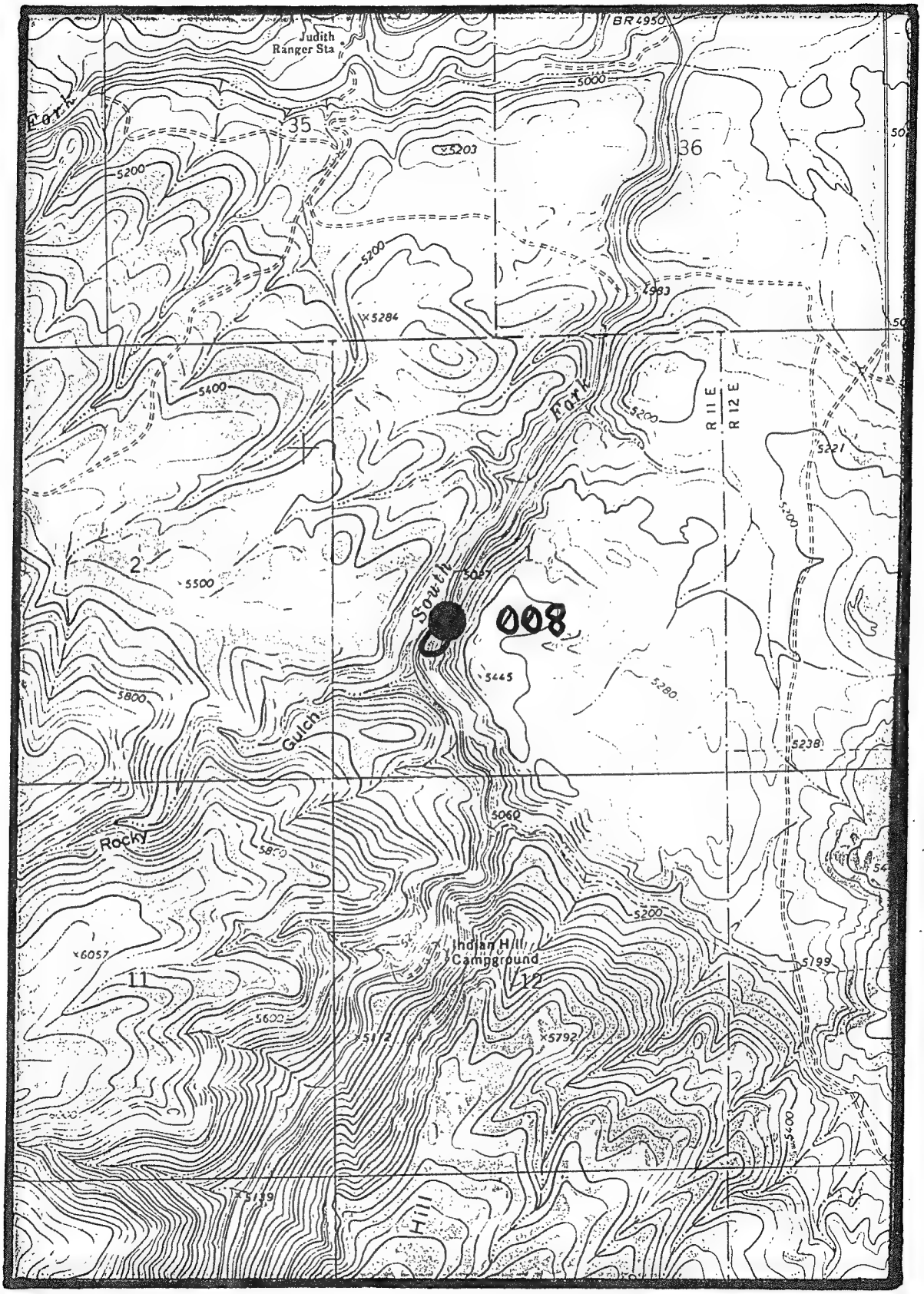
USGS Indian Hill (7.5') Quadrangle



Aquilegia brevistyla

Hay Canyon (007)
South Fork Judith River

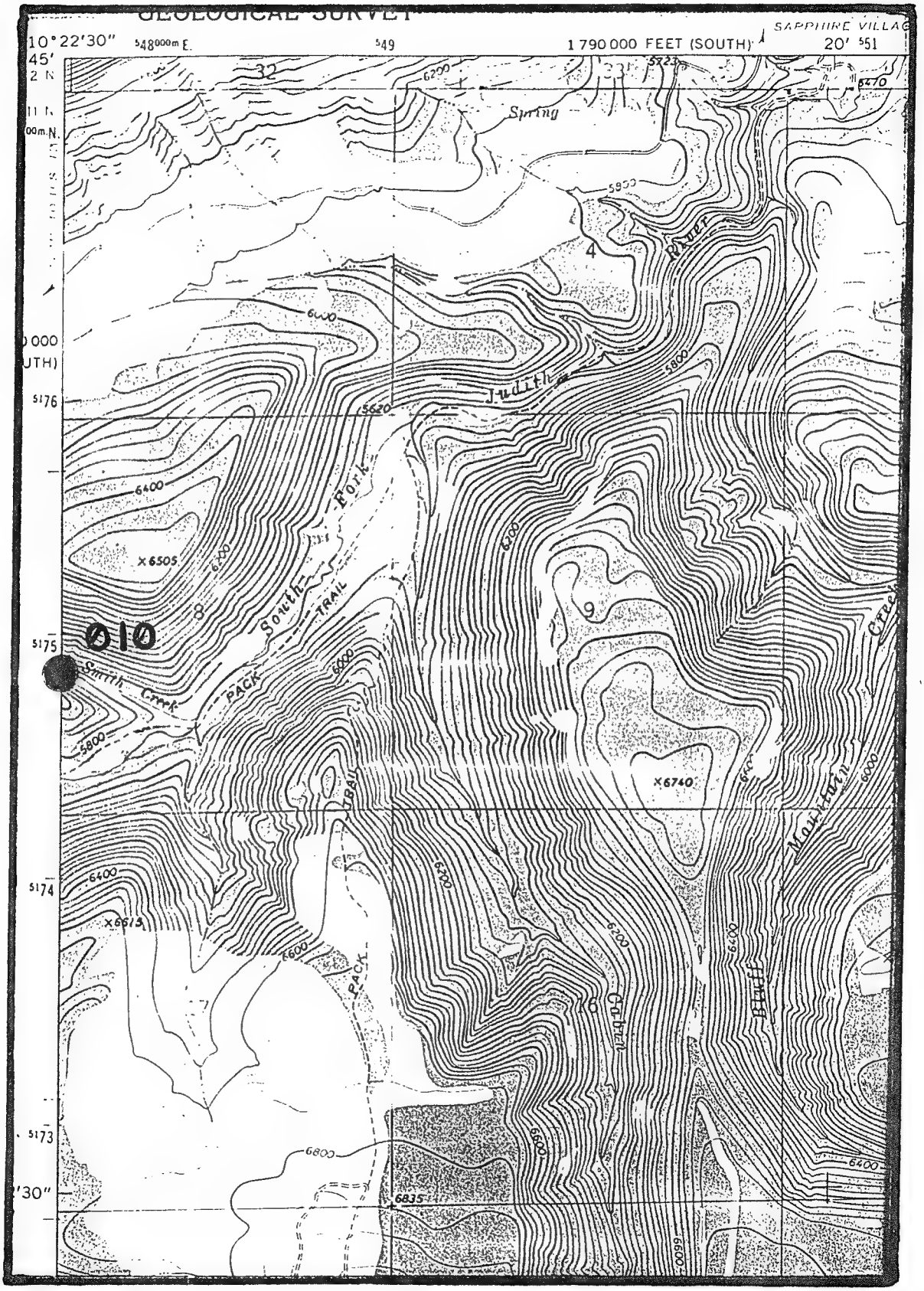
Montana USGS Indian Hill (7.5') Quadrangle



Aquilegia brevistyla

South Fork Judith River (008)

Montana USGS Daisy Peak (7.5') Quadrangle



Aquilegia brevistyla

Smith Creek (010)

VI. PHOTOGRAPHS

A. Aquilegia brevistyla - flower, Dry Pole (001). Note short, curved spurs.

B. Aquilegia brevistyla - habit, Dry Pole (001).

C. Aquilegia brevistyla - habitat. Note vegetation cover.

D. Aquilegia brevistyla - habitat, Dry Pole (001). South Fork Judith River drainage, Montana.

E. Putative hybrid between Aquilegia brevistyla and A. flavescens, Dry Pole (001), South Fork Judith River drainage, Montana. Note long, straight spurs, exserted stamens, and blue coloration.